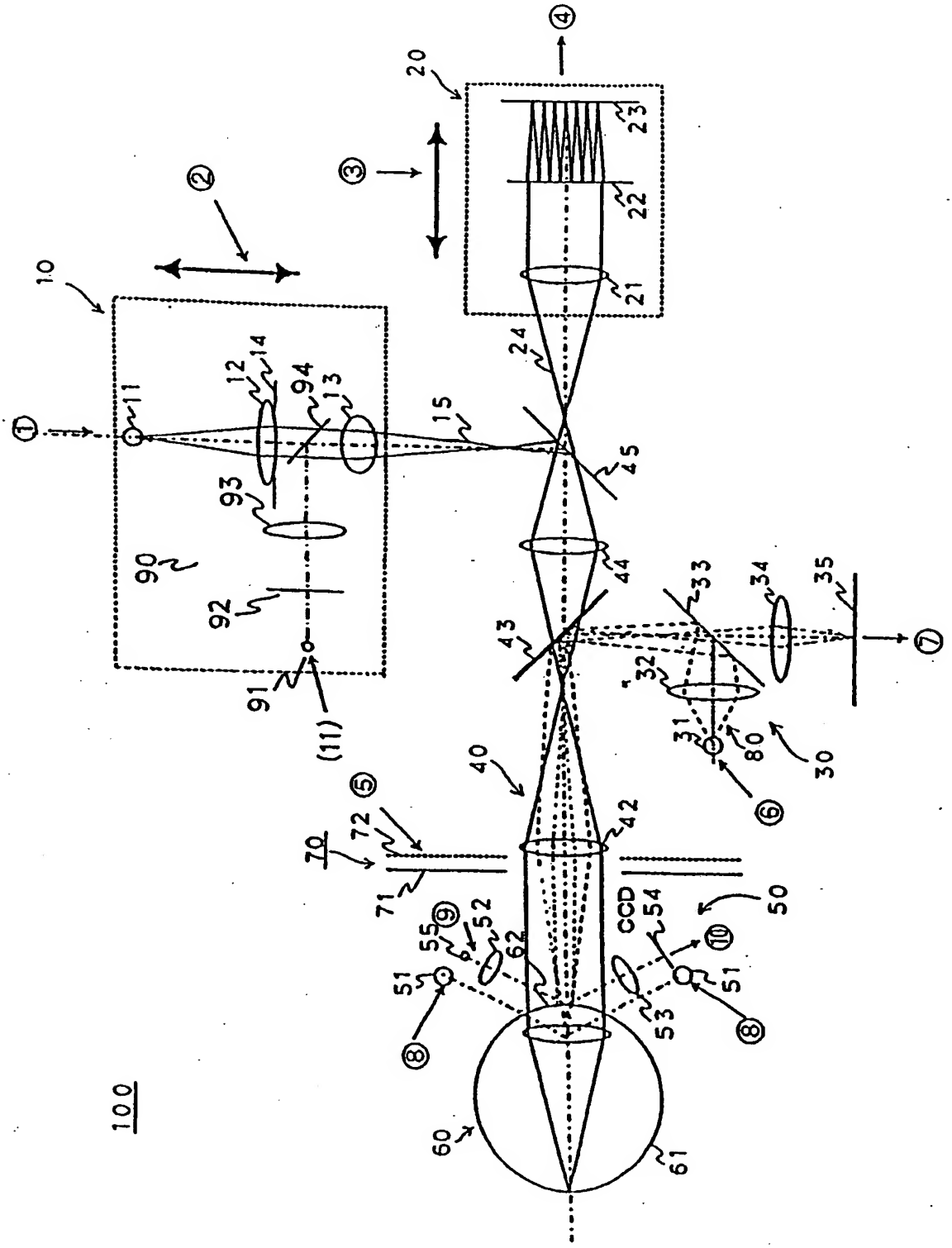
100
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94
CCD
(11)
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⑨
⑩

FIG.1

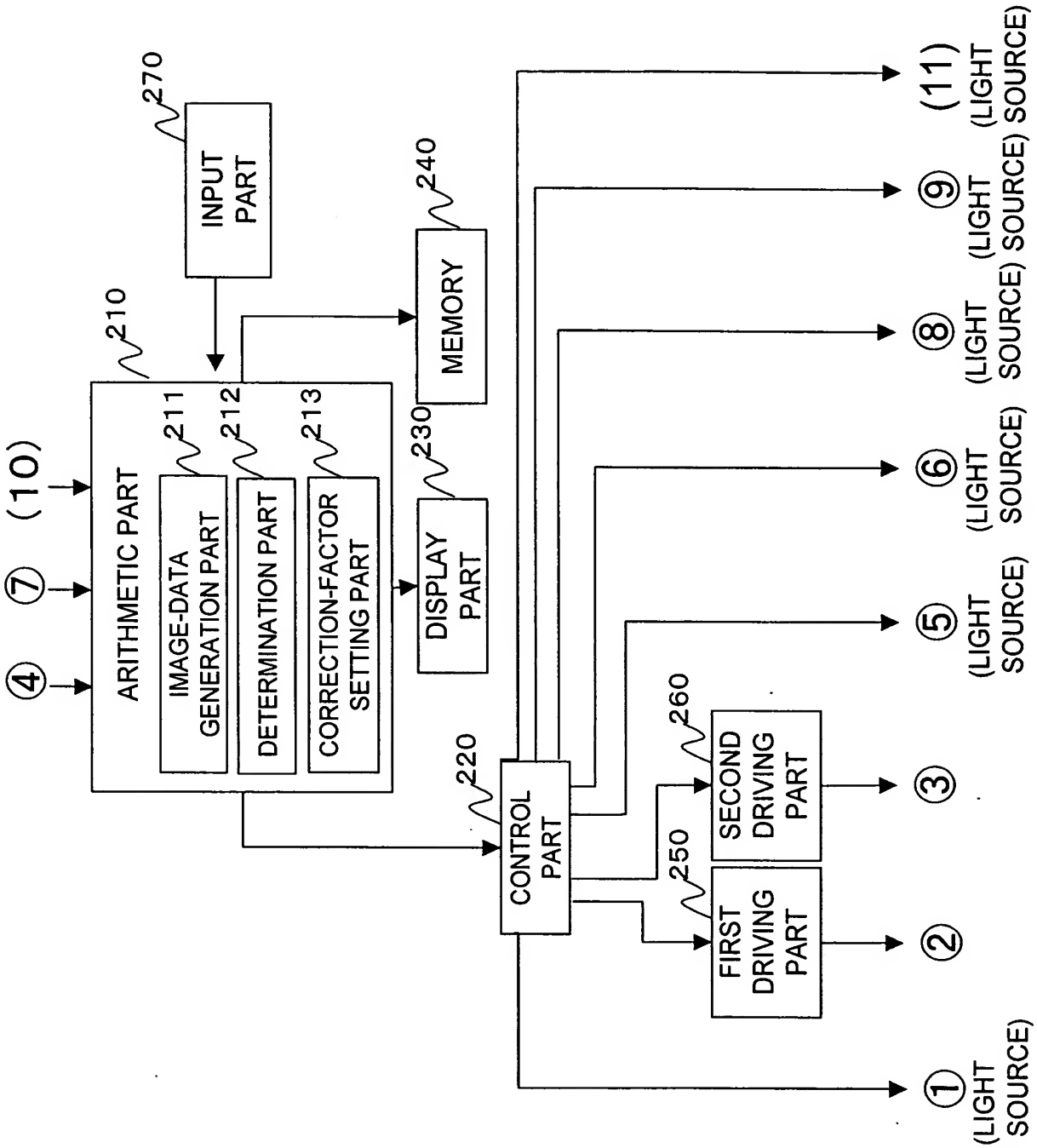
270
INPUT PART
240
MEMORY
210
ARITHMETIC PART
211
IMAGE-DATA GENERATION PART
212
DETERMINATION PART
213
CORRECTION-FACTOR SETTING PART
230
DISPLAY PART
④
⑦
(10)
220
CONTROL PART
260
SECOND DRIVING PART
250
FIRST DRIVING PART
①
(LIGHT SOURCE)
②
③
⑤
(LIGHT SOURCE)
⑥
(LIGHT SOURCE)
⑧
(LIGHT SOURCE)
⑨
(LIGHT SOURCE)
(11)
(LIGHT SOURCE)

FIG.2

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i	2j − i	
0	0	1
1	−1	$r \sin(t)$
1	1	$\cos(t)\, r$
2	−2	$r^2 \sin(2t)$
2	0	$2r^2 - 1$
2	2	$r^2 \cos(2t)$
3	−3	$r^3 \sin(3t)$
3	−1	$(3r^3 - 2r)\sin(t)$
3	1	$(3r^3 - 2r)\cos(t)$
3	3	$r^3 \cos(3t)$
4	−4	$r^4 \sin(4t)$
4	−2	$(4r^4 - 3r^2)\sin(2t)$
4	0	$6r^4 - 6r^2 + 1$
4	2	$(4r^4 - 3r^2)\cos(2t)$
4	4	$r^4 \cos(4t)$
5	−5	$r^5 \sin(5t)$
5	−3	$(5r^5 - 4r^3)\sin(3t)$
5	−1	$(10r^5 - 12r^3 + 3r)\sin(t)$
5	1	$(10r^5 - 12r^3 + 3r)\cos(t)$
5	3	$(5r^5 - 4r^3)\cos(3t)$
5	5	$r^5 \cos(5t)$
6	−6	$r^6 \sin(6t)$
6	−4	$(6r^6 - 5r^4)\sin(4t)$
6	−2	$(15r^6 - 20r^4 + 6r^2)\sin(2t)$
6	0	$20r^6 - 30r^4 + 12r^2 - 1$
6	2	$(15r^6 - 20r^4 + 6r^2)\cos(2t)$
6	4	$(6r^6 - 5r^4)\cos(4t)$
6	6	$r^6 \cos(6t)$

FIG.3

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i	2j − i	
0	0	1
1	−1	y
1	1	x
2	−2	$2yx$
2	0	$2x^2+2y^2-1$
2	2	x^2-y^2
3	−3	$3yx^2-y^3$
3	−1	$3yx^2+3y^3-2y$
3	1	$3x^3+3xy^2-2x$
3	3	x^3-3xy^2
4	−4	$4yx^3-4y^3x$
4	−2	$8yx^3+8y^3x-6yx$
4	0	$6x^4+12x^2y^2+6y^4-6x^2-6y^2+1$
4	2	$4x^4-4y^4-3x^2+3y^2$
4	4	$x^4-6x^2y^2+y^4$
5	−5	$5yx^4-10y^3x^2+y^5$
5	−3	$15yx^4+10y^3x^2-5y^5-12yx^2+4y^3$
5	−1	$10yx^4+20y^3x^2+10y^5-12yx^2-12y^3+3y$
5	1	$10x^5+20x^3y^2+10xy^4-12x^3-12xy^2+3x$
5	3	$5x^5-10x^3y^2-15xy^4-4x^3+12xy^2$
5	5	$x^5-10x^3y^2+5xy^4$
6	−6	$6yx^5-20y^3x^3+6y^5x$
6	−4	$24yx^5-24y^5x-20yx^3+20y^3x$
6	−2	$30yx^5+60y^3x^3+30y^5x-40yx^3-40y^3x+12yx$
6	0	$20x^6+60x^4y^2+60x^2y^4+20y^6-30x^4-60x^2y^2-30y^4+12x^2+12y^2-1$
6	2	$15x^6+15x^4y^2-15x^2y^4-15y^6-20x^4+20y^4+6x^2-6y^2$
6	4	$6x^6-30x^4y^2-30x^2y^4+6y^6-5x^4+30x^2y^2-5y^4$
6	6	$x^6-15x^4y^2+15x^2y^4-y^6$

FIG.4

10/527447

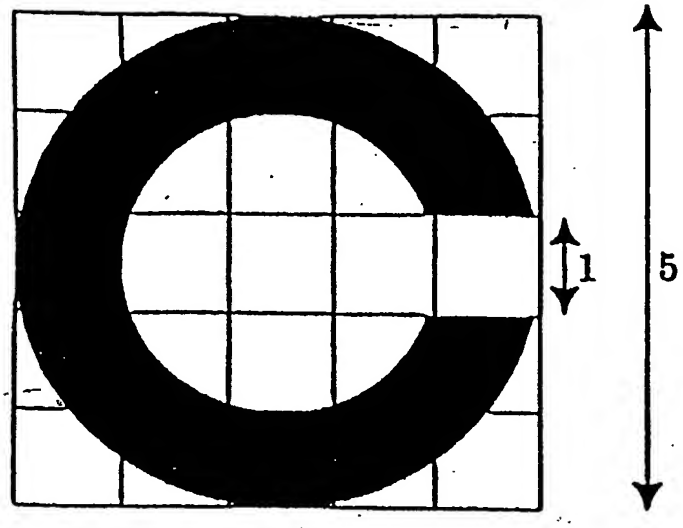

FIG.5

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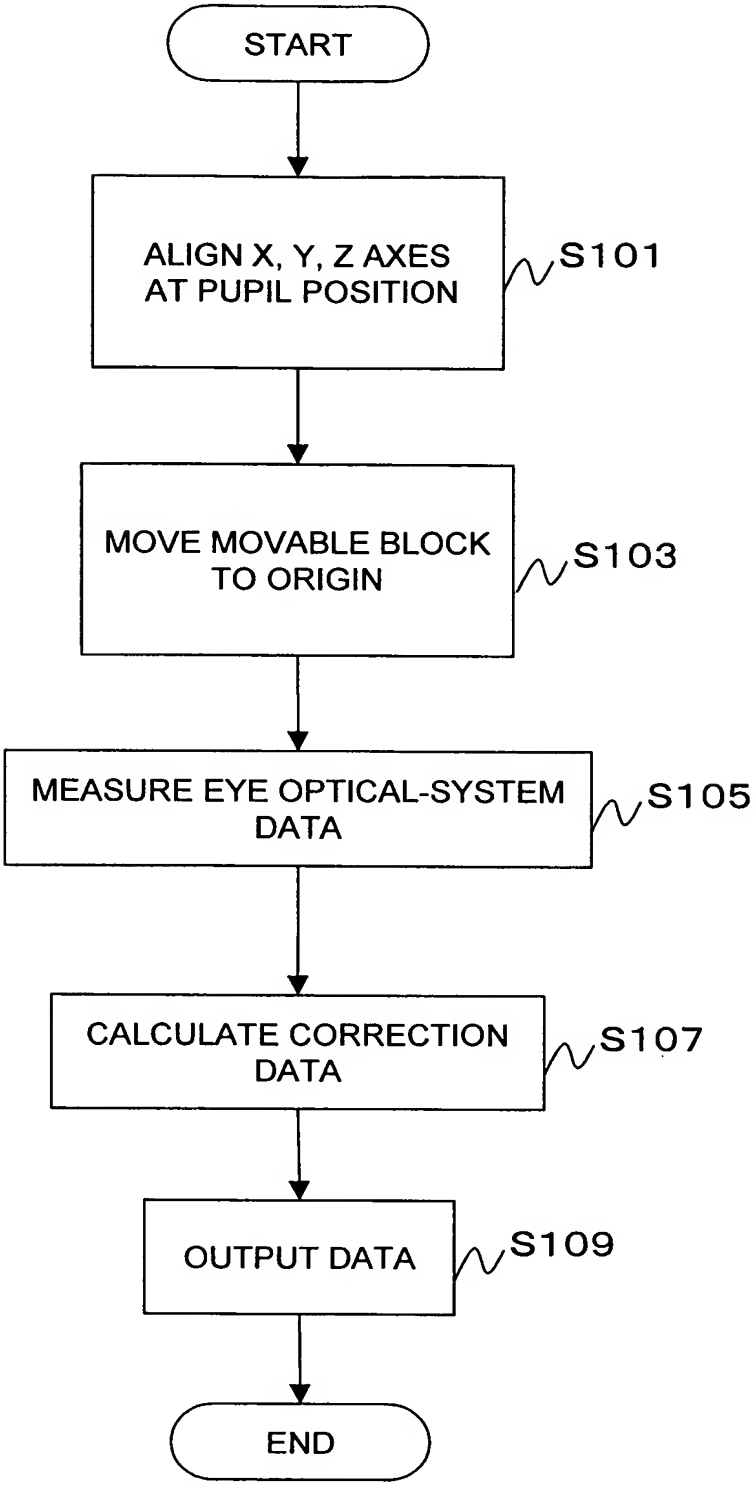
START
ALIGN X, Y, Z AXES AT PUPIL POSITION
S101
MOVE MOVABLE BLOCK TO ORIGIN
S103
MEASURE EYE OPTICAL-SYSTEM DATA
S105
CALCULATE CORRECTION DATA
S107
OUTPUT DATA
S109
END

Fig.6

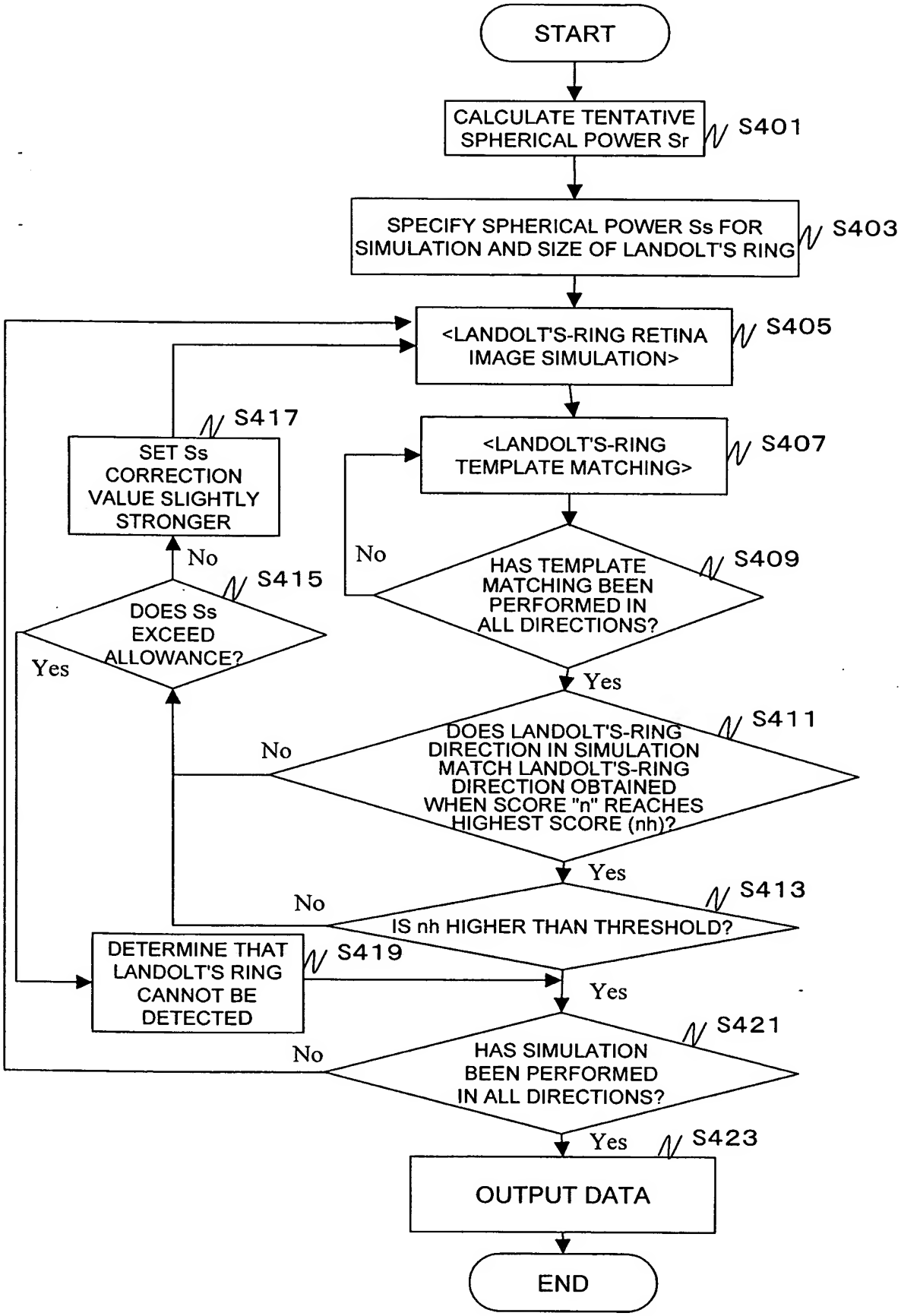
START
CALCULATE TENTATIVE SPHERICAL POWER Sr
S401
SPECIFY SPHERICAL POWER Ss FOR SIMULATION AND SIZE OF LANDOLT'S RING
S403
<LANDOLT'S-RING RETINA IMAGE SIMULATION>
S405
<LANDOLT'S-RING TEMPLATE MATCHING>
S407
HAS TEMPLATE MATCHING BEEN PERFORMED IN ALL DIRECTIONS?
S409
No
Yes
DOES LANDOLT'S-RING DIRECTION IN SIMULATION MATCH LANDOLT'S-RING DIRECTION OBTAINED WHEN SCORE "n" REACHES HIGHEST SCORE (nh)?
S411
No
Yes
IS nh HIGHER THAN THRESHOLD?
S413
No
Yes
DOES Ss EXCEED ALLOWANCE?
S415
No
Yes
SET Ss CORRECTION VALUE SLIGHTLY STRONGER
S417
DETERMINE THAT LANDOLT'S RING CANNOT BE DETECTED
S419
HAS SIMULATION BEEN PERFORMED IN ALL DIRECTIONS?
S421
No
Yes
OUTPUT DATA
S423
END

Fig.7

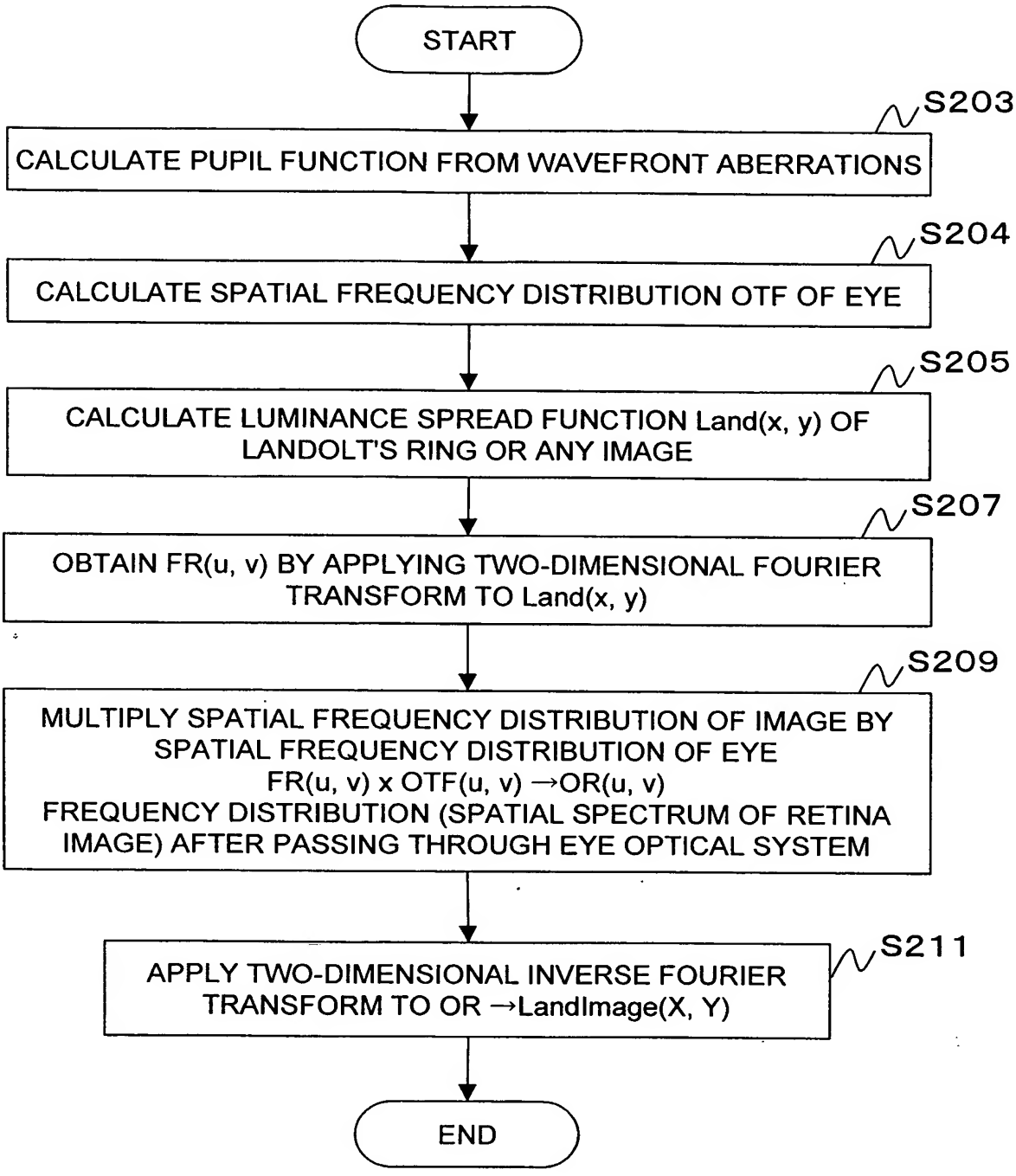
START
S203
CALCULATE PUPIL FUNCTION FROM WAVEFRONT ABERRATIONS
S204
CALCULATE SPATIAL FREQUENCY DISTRIBUTION OTF OF EYE
S205
CALCULATE LUMINANCE SPREAD FUNCTION Land(x, y) OF LANDOLT'S RING OR ANY IMAGE
S207
OBTAIN FR(u, v) BY APPLYING TWO-DIMENSIONAL FOURIER TRANSFORM TO Land(x, y)
S209
MULTIPLY SPATIAL FREQUENCY DISTRIBUTION OF IMAGE BY SPATIAL FREQUENCY DISTRIBUTION OF EYE
FR(u, v) x OTF(u, v) →OR(u, v)
FREQUENCY DISTRIBUTION (SPATIAL SPECTRUM OF RETINA IMAGE) AFTER PASSING THROUGH EYE OPTICAL SYSTEM
S211
APPLY TWO-DIMENSIONAL INVERSE FOURIER TRANSFORM TO OR →LandImage(X, Y)
END

Fig.8

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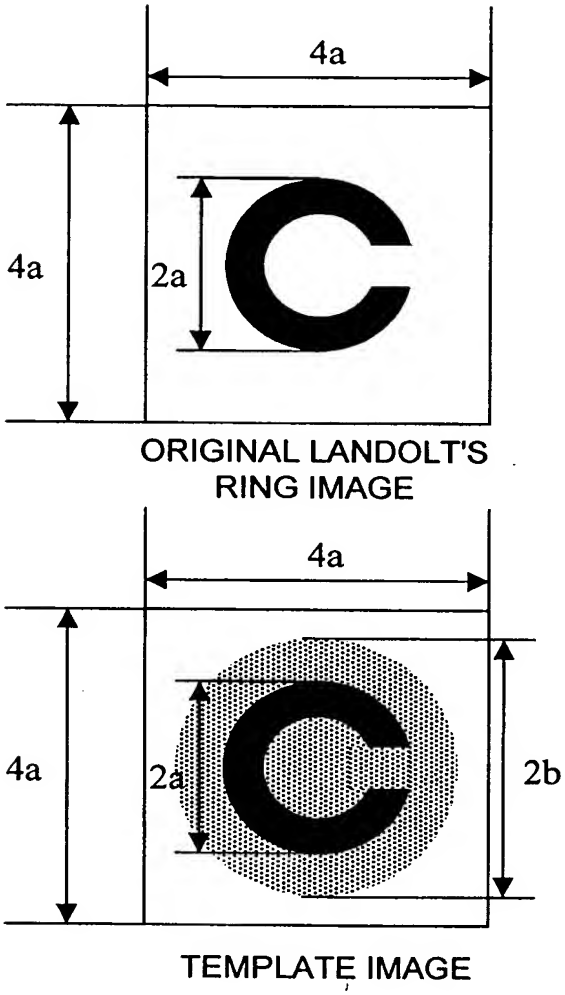

Fig.9

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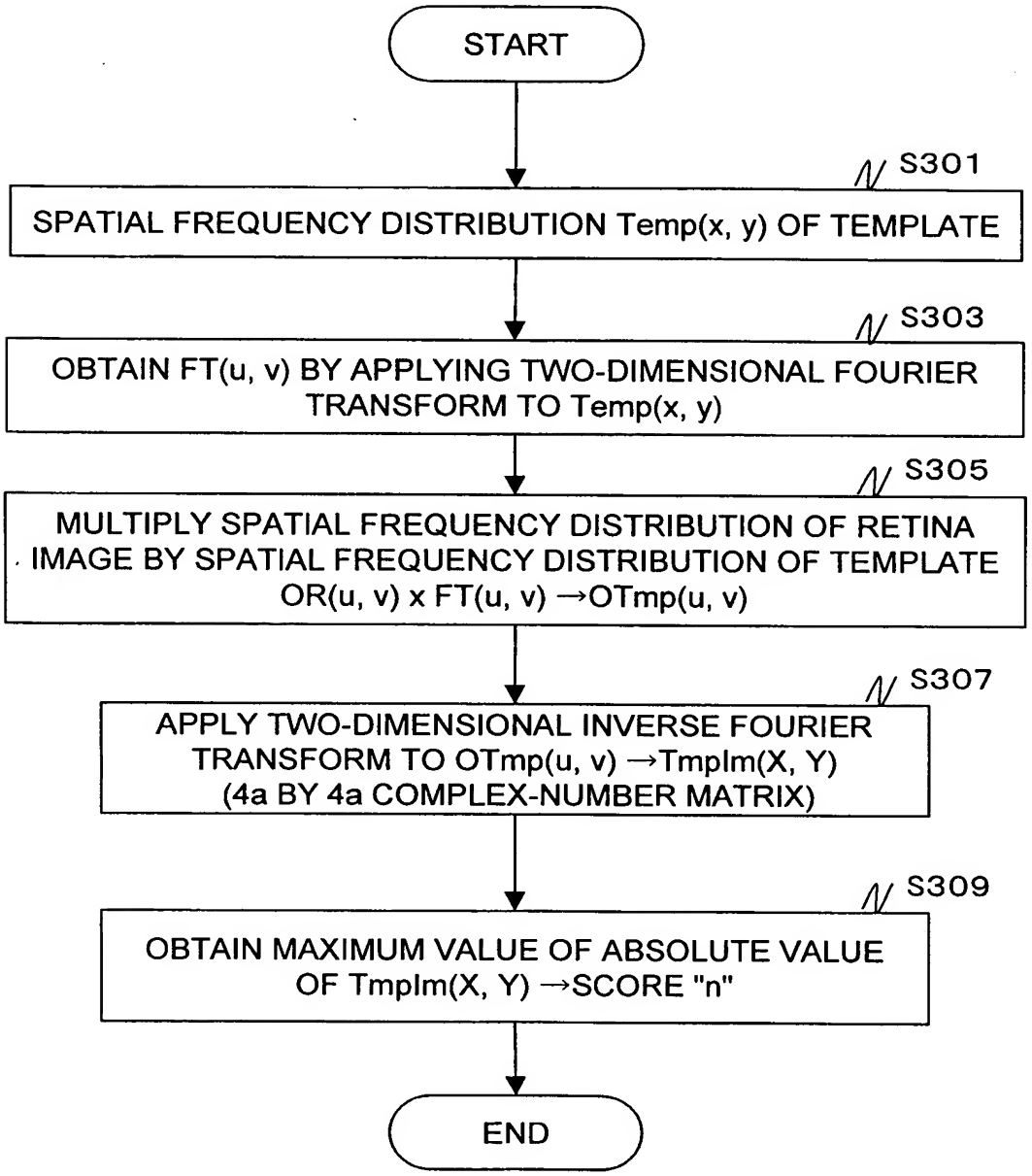
START
S301
SPATIAL FREQUENCY DISTRIBUTION Temp(x, y) OF TEMPLATE
S303
OBTAIN FT(u, v) BY APPLYING TWO-DIMENSIONAL FOURIER TRANSFORM TO Temp(x, y)
S305
MULTIPLY SPATIAL FREQUENCY DISTRIBUTION OF RETINA IMAGE BY SPATIAL FREQUENCY DISTRIBUTION OF TEMPLATE
OR(u, v) x FT(u, v) →OTmp(u, v)
S307
APPLY TWO-DIMENSIONAL INVERSE FOURIER TRANSFORM TO OTmp(u, v) →TmpIm(X, Y)
(4a BY 4a COMPLEX-NUMBER MATRIX)
S309
OBTAIN MAXIMUM VALUE OF ABSOLUTE VALUE OF TmpIm(X, Y) →SCORE "n"
END

Fig.10

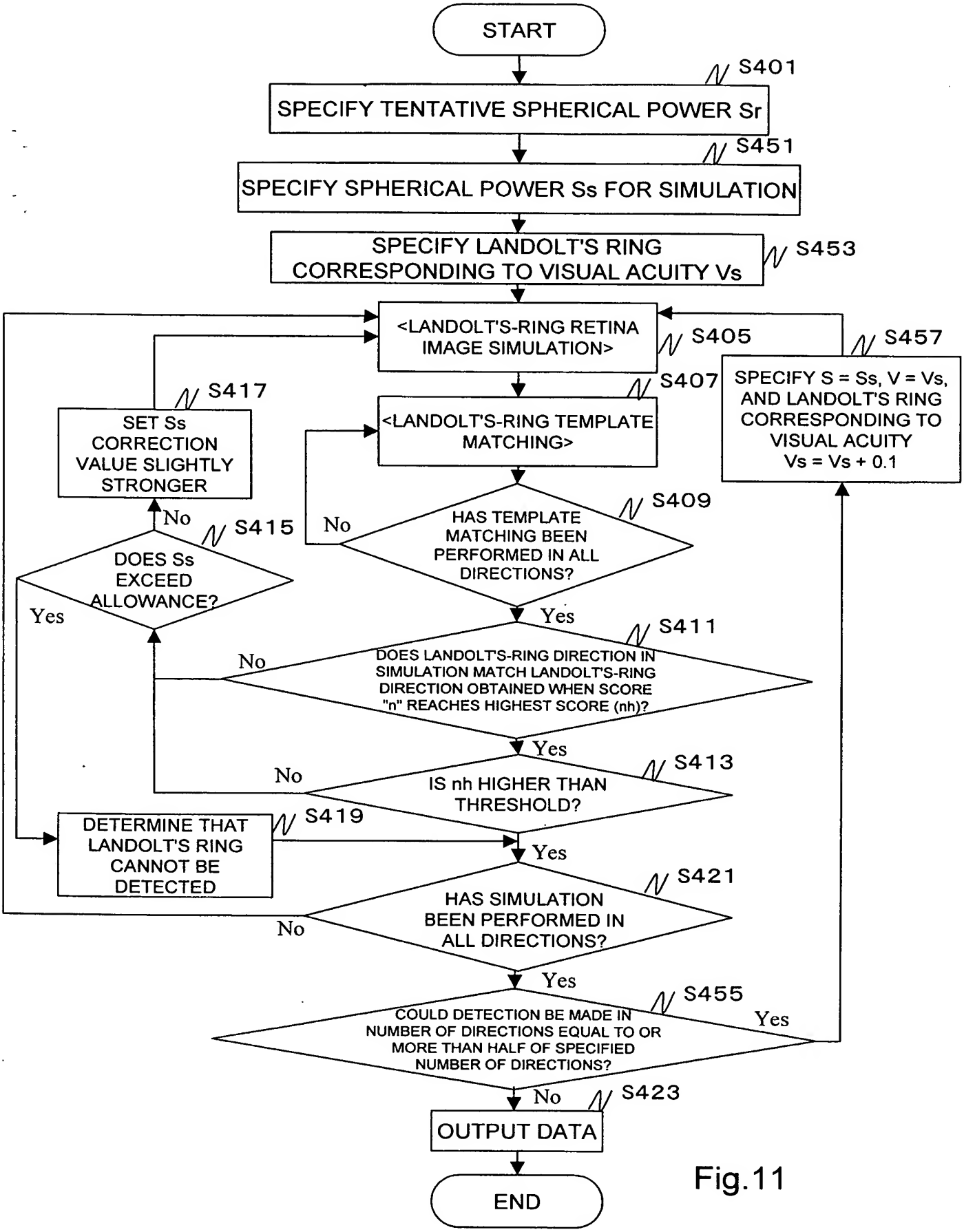
START
S401
SPECIFY TENTATIVE SPHERICAL POWER Sr
S451
SPECIFY SPHERICAL POWER Ss FOR SIMULATION
SPECIFY LANDOLT'S RING CORRESPONDING TO VISUAL ACUITY Vs
S453
<LANDOLT'S-RING RETINA IMAGE SIMULATION>
S405
S457
SPECIFY S = Ss, V = Vs, AND LANDOLT'S RING CORRESPONDING TO VISUAL ACUITY Vs = Vs + 0.1
S407
<LANDOLT'S-RING TEMPLATE MATCHING>
S417
SET Ss CORRECTION VALUE SLIGHTLY STRONGER
S409
HAS TEMPLATE MATCHING BEEN PERFORMED IN ALL DIRECTIONS?
No
S415
DOES Ss EXCEED ALLOWANCE?
No
Yes
Yes
S411
DOES LANDOLT'S-RING DIRECTION IN SIMULATION MATCH LANDOLT'S-RING DIRECTION OBTAINED WHEN SCORE "n" REACHES HIGHEST SCORE (nh)?
No
Yes
S413
IS nh HIGHER THAN THRESHOLD?
No
S419
DETERMINE THAT LANDOLT'S RING CANNOT BE DETECTED
Yes
S421
HAS SIMULATION BEEN PERFORMED IN ALL DIRECTIONS?
No
Yes
S455
COULD DETECTION BE MADE IN NUMBER OF DIRECTIONS EQUAL TO OR MORE THAN HALF OF SPECIFIED NUMBER OF DIRECTIONS?
Yes
No
S423
OUTPUT DATA
END

Fig.11

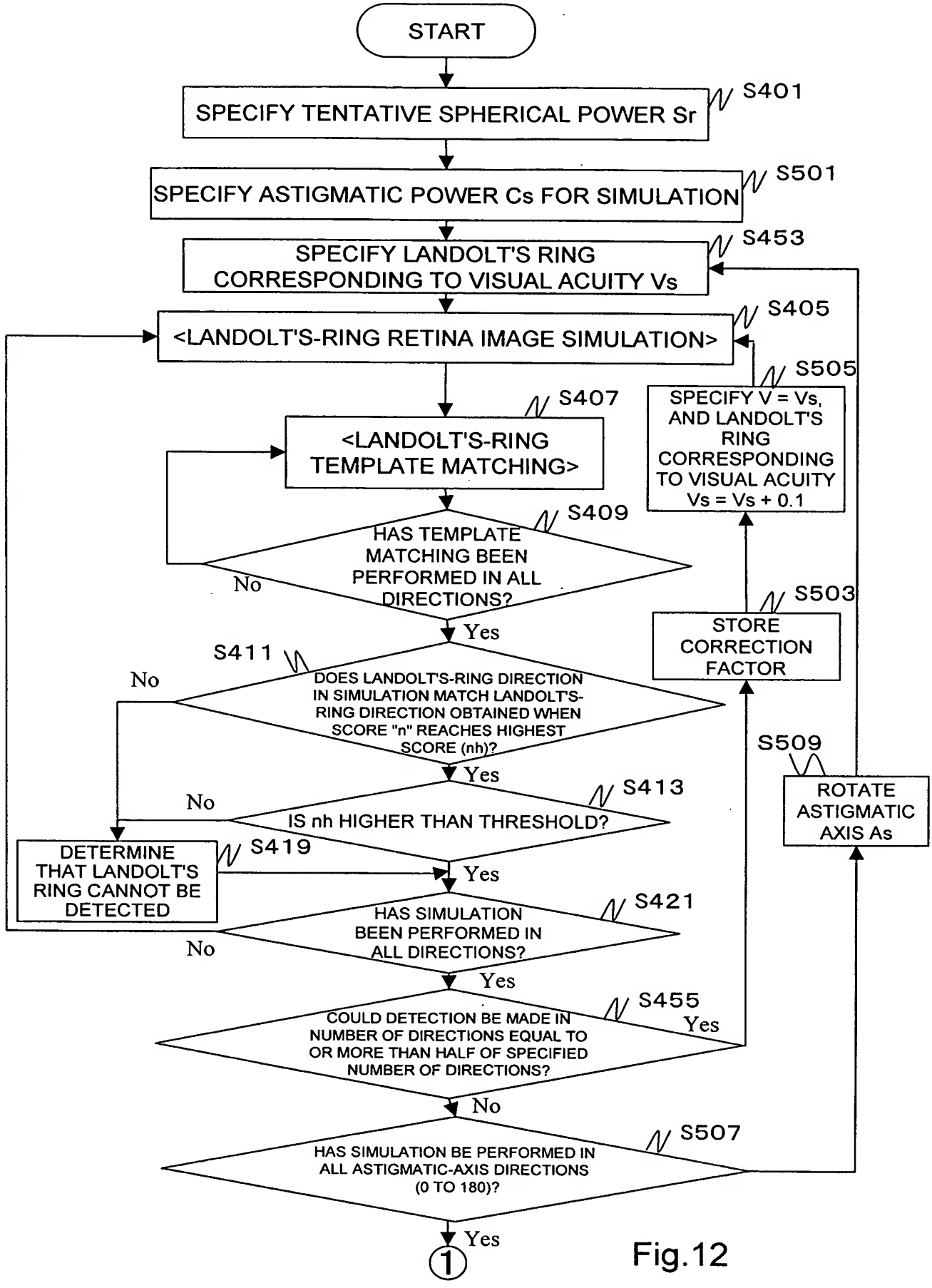
START
SPECIFY TENTATIVE SPHERICAL POWER Sr
S401
SPECIFY ASTIGMATIC POWER Cs FOR SIMULATION
S501
SPECIFY LANDOLT'S RING CORRESPONDING TO VISUAL ACUITY Vs
S453
<LANDOLT'S-RING RETINA IMAGE SIMULATION>
S405
<LANDOLT'S-RING TEMPLATE MATCHING>
S407
HAS TEMPLATE MATCHING BEEN PERFORMED IN ALL DIRECTIONS?
S409
No
Yes
DOES LANDOLT'S-RING DIRECTION IN SIMULATION MATCH LANDOLT'S-RING DIRECTION OBTAINED WHEN SCORE "n" REACHES HIGHEST SCORE (nh)?
S411
No
Yes
IS nh HIGHER THAN THRESHOLD?
S413
No
Yes
DETERMINE THAT LANDOLT'S RING CANNOT BE DETECTED
S419
HAS SIMULATION BEEN PERFORMED IN ALL DIRECTIONS?
S421
No
Yes
COULD DETECTION BE MADE IN NUMBER OF DIRECTIONS EQUAL TO OR MORE THAN HALF OF SPECIFIED NUMBER OF DIRECTIONS?
S455
Yes
No
HAS SIMULATION BE PERFORMED IN ALL ASTIGMATIC-AXIS DIRECTIONS (0 TO 180)?
S507
Yes
1
SPECIFY V = Vs, AND LANDOLT'S RING CORRESPONDING TO VISUAL ACUITY Vs = Vs + 0.1
S505
STORE CORRECTION FACTOR
S503
ROTATE ASTIGMATIC AXIS As
S509

Fig.12

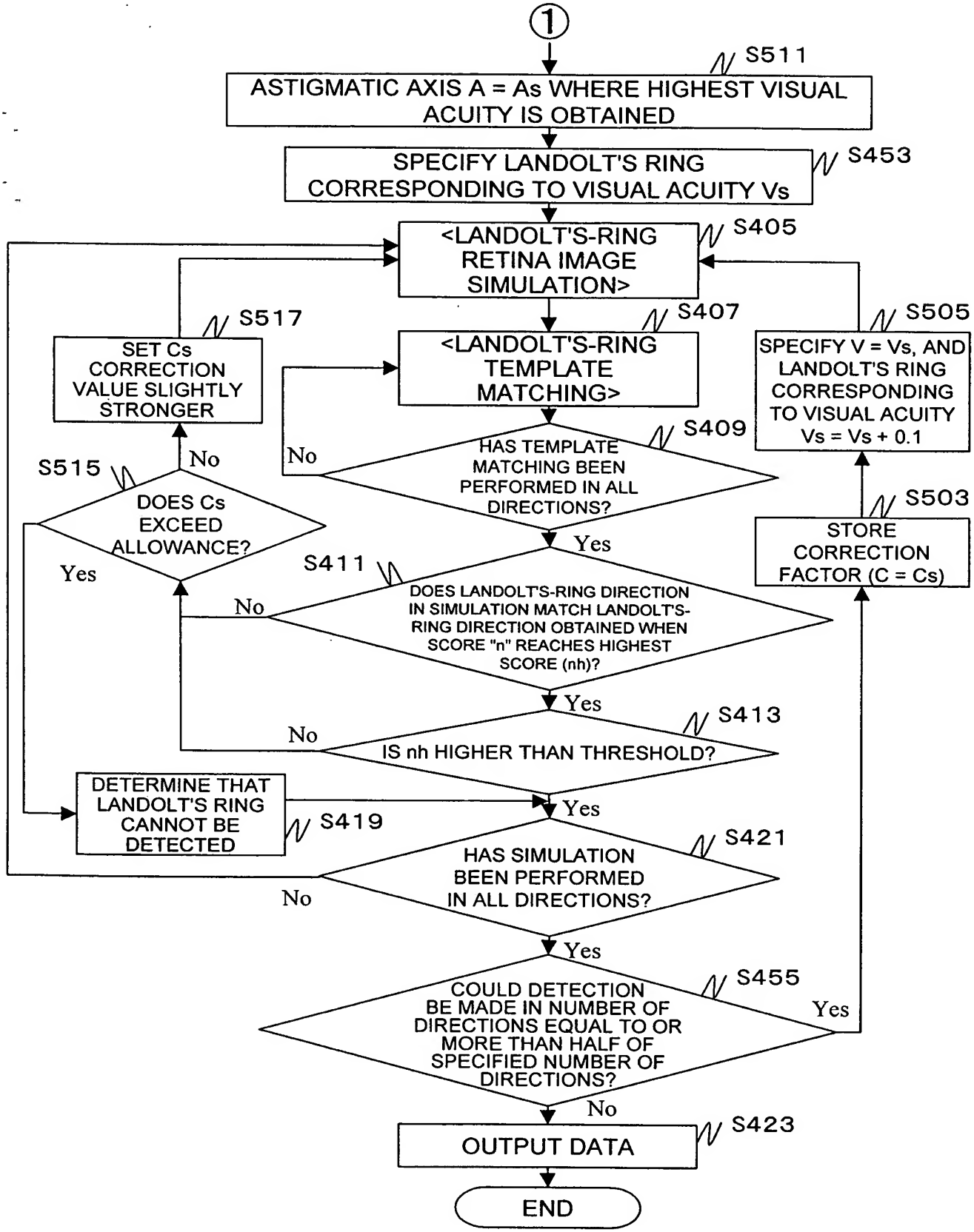
①
S511
ASTIGMATIC AXIS A = As WHERE HIGHEST VISUAL ACUITY IS OBTAINED
S453
SPECIFY LANDOLT'S RING CORRESPONDING TO VISUAL ACUITY Vs
S405
<LANDOLT'S-RING RETINA IMAGE SIMULATION>
S407
<LANDOLT'S-RING TEMPLATE MATCHING>
S409
HAS TEMPLATE MATCHING BEEN PERFORMED IN ALL DIRECTIONS?
No
Yes
S411
DOES LANDOLT'S-RING DIRECTION IN SIMULATION MATCH LANDOLT'S-RING DIRECTION OBTAINED WHEN SCORE "n" REACHES HIGHEST SCORE (nh)?
No
Yes
S413
IS nh HIGHER THAN THRESHOLD?
No
Yes
S421
HAS SIMULATION BEEN PERFORMED IN ALL DIRECTIONS?
No
Yes
S455
COULD DETECTION BE MADE IN NUMBER OF DIRECTIONS EQUAL TO OR MORE THAN HALF OF SPECIFIED NUMBER OF DIRECTIONS?
Yes
No
S423
OUTPUT DATA
END
S505
SPECIFY V = Vs, AND LANDOLT'S RING CORRESPONDING TO VISUAL ACUITY Vs = Vs + 0.1
S503
STORE CORRECTION FACTOR (C = Cs)
S517
SET Cs CORRECTION VALUE SLIGHTLY STRONGER
S515
DOES Cs EXCEED ALLOWANCE?
No
Yes
S419
DETERMINE THAT LANDOLT'S RING CANNOT BE DETECTED

Fig.13

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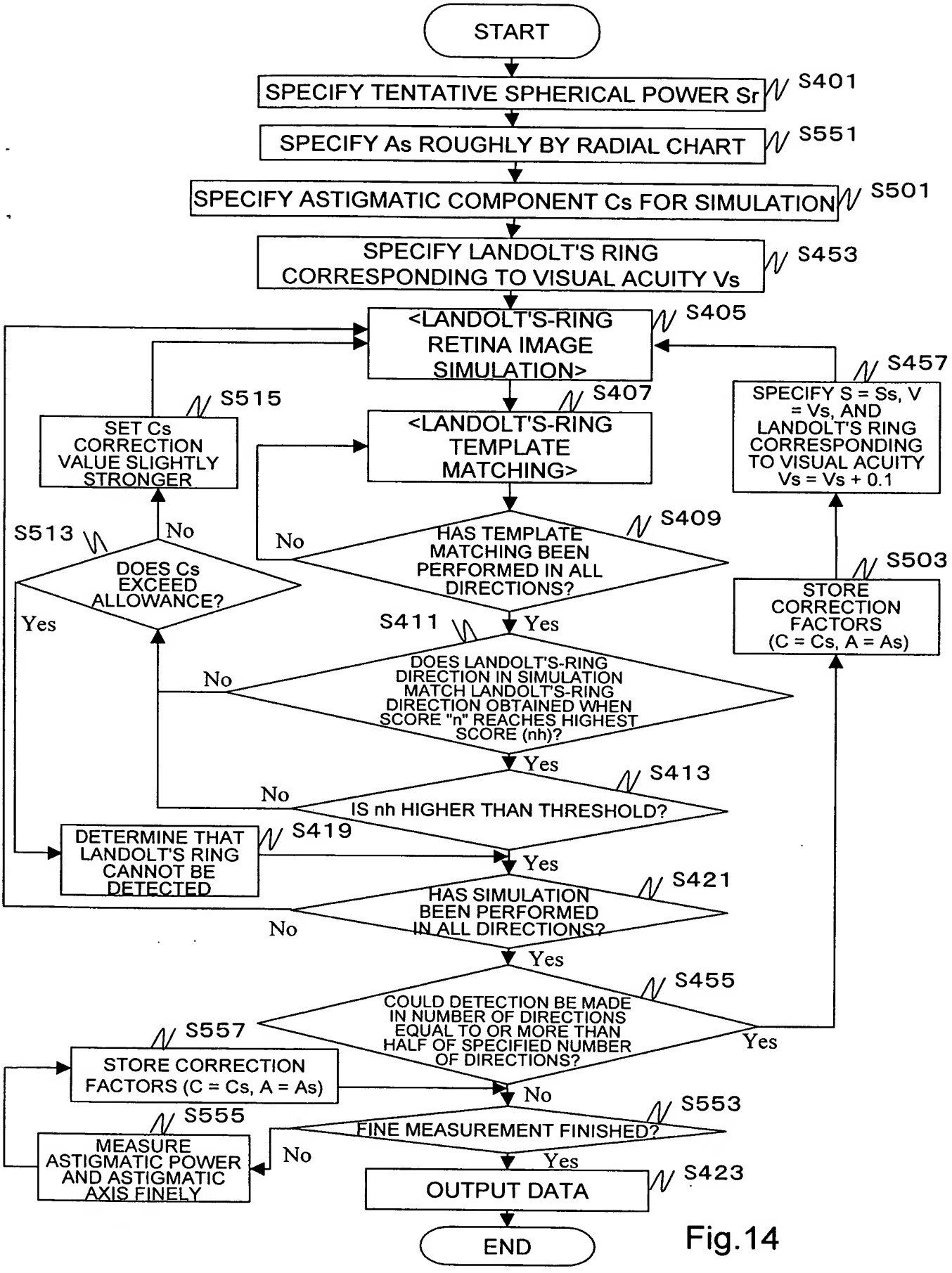

Fig.14

10/527447

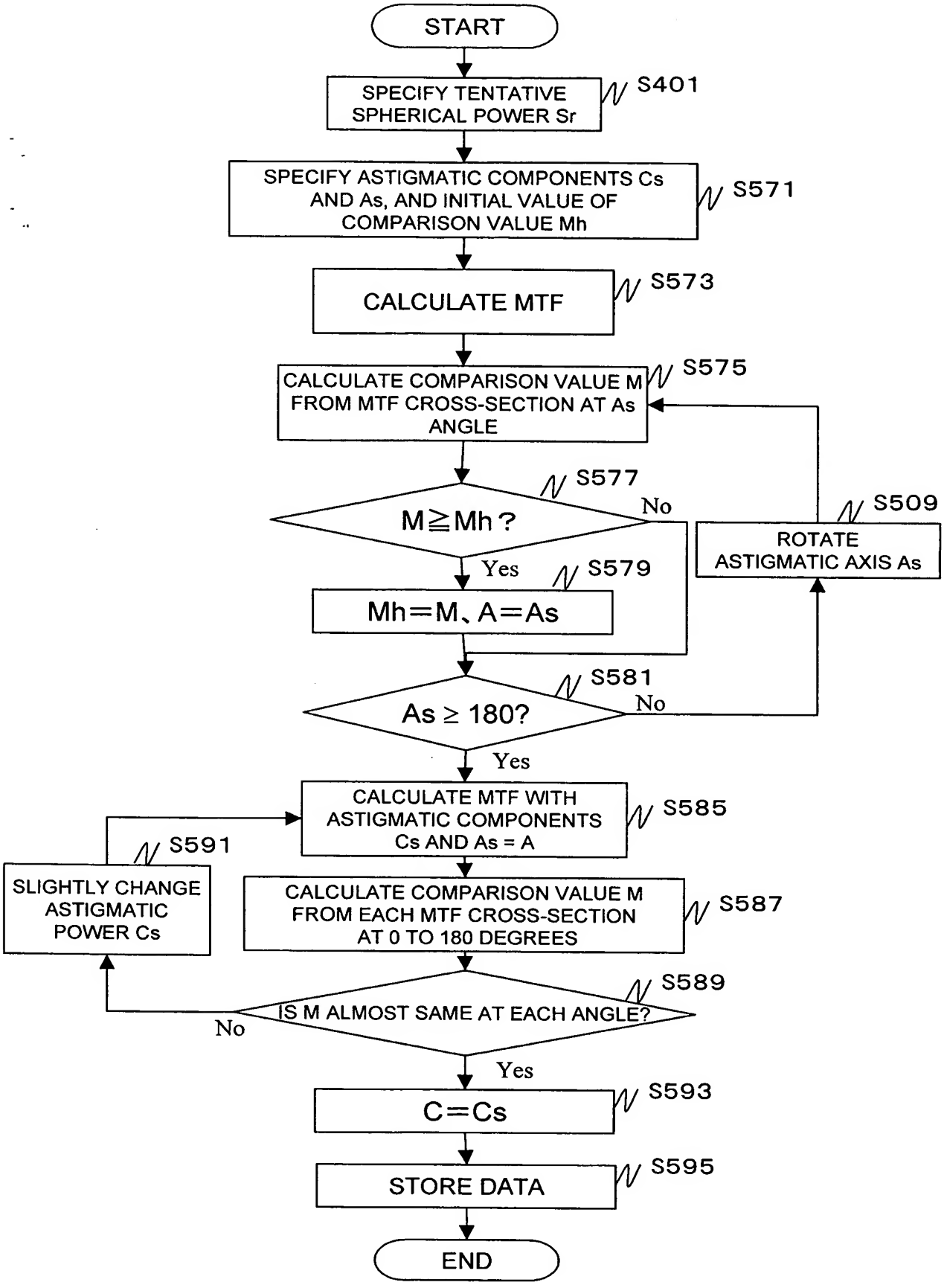

Fig.15

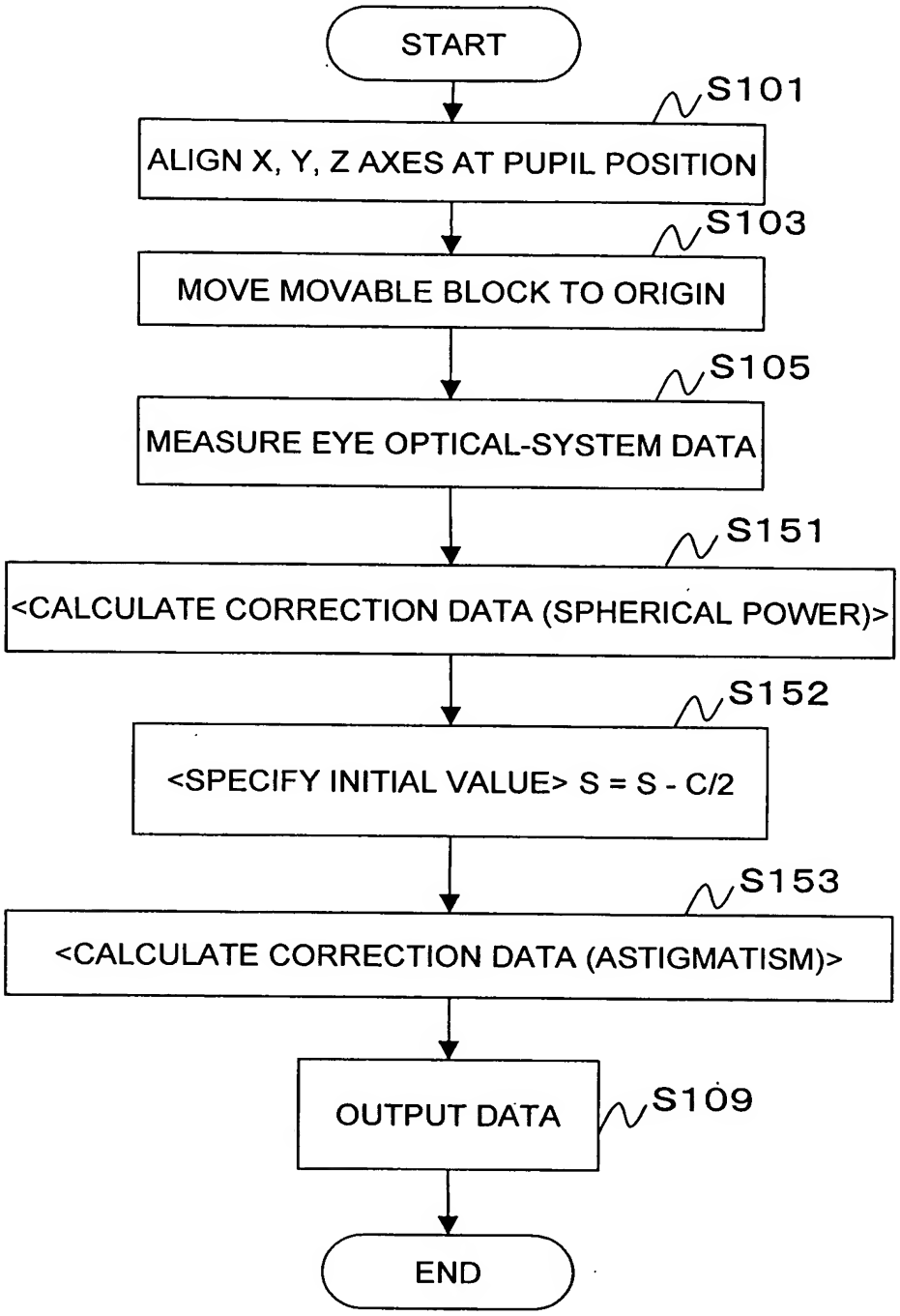
START
S101
ALIGN X, Y, Z AXES AT PUPIL POSITION
S103
MOVE MOVABLE BLOCK TO ORIGIN
S105
MEASURE EYE OPTICAL-SYSTEM DATA
S151
<CALCULATE CORRECTION DATA (SPHERICAL POWER)>
S152
<SPECIFY INITIAL VALUE> S = S - C/2
S153
<CALCULATE CORRECTION DATA (ASTIGMATISM)>
OUTPUT DATA
S109
END

Fig.16

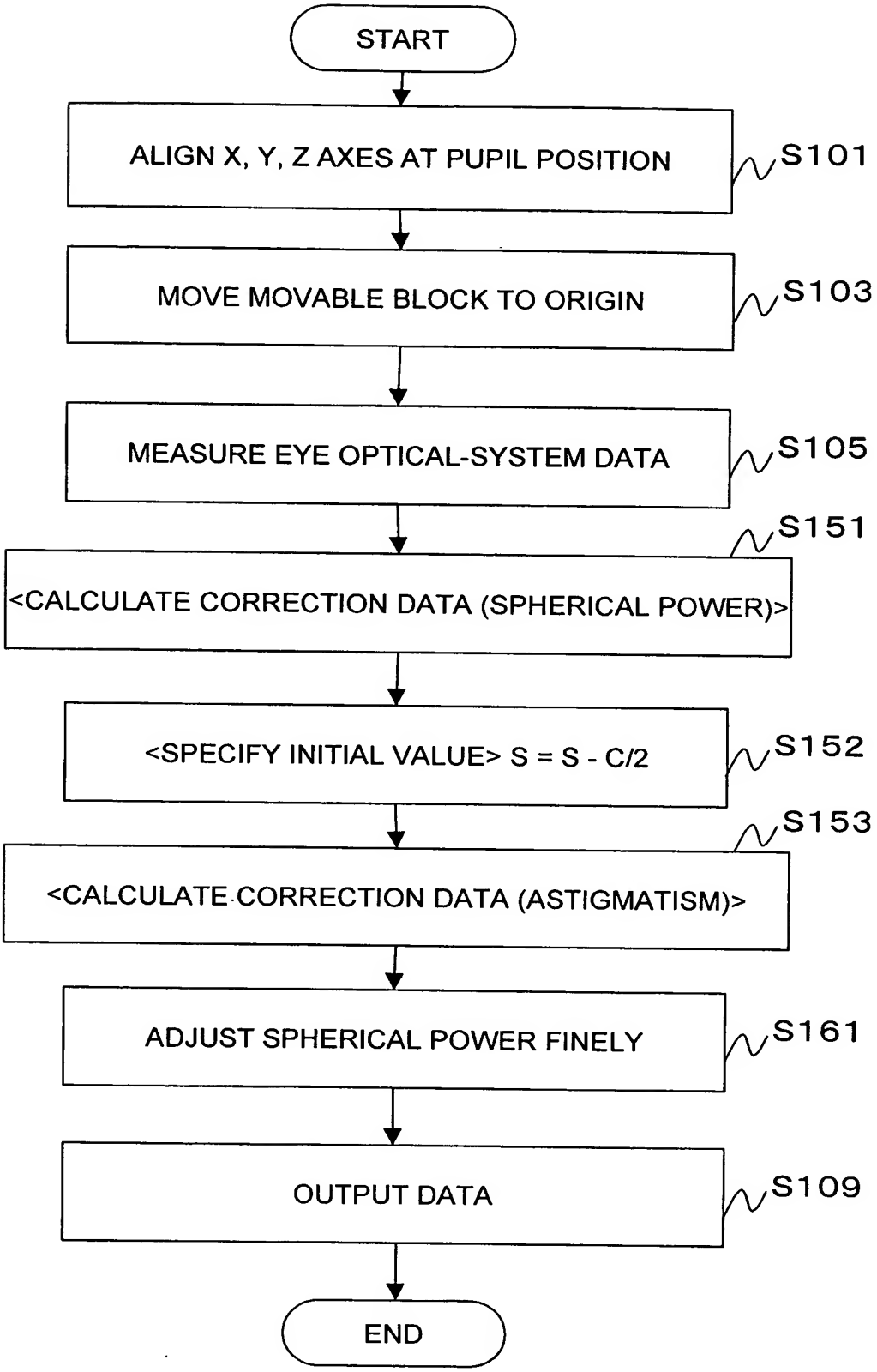
START
ALIGN X, Y, Z AXES AT PUPIL POSITION
S101
MOVE MOVABLE BLOCK TO ORIGIN
S103
MEASURE EYE OPTICAL-SYSTEM DATA
S105
S151
<CALCULATE CORRECTION DATA (SPHERICAL POWER)>
<SPECIFY INITIAL VALUE> S = S - C/2
S152
S153
<CALCULATE CORRECTION DATA (ASTIGMATISM)>
ADJUST SPHERICAL POWER FINELY
S161
OUTPUT DATA
S109
END

Fig.17

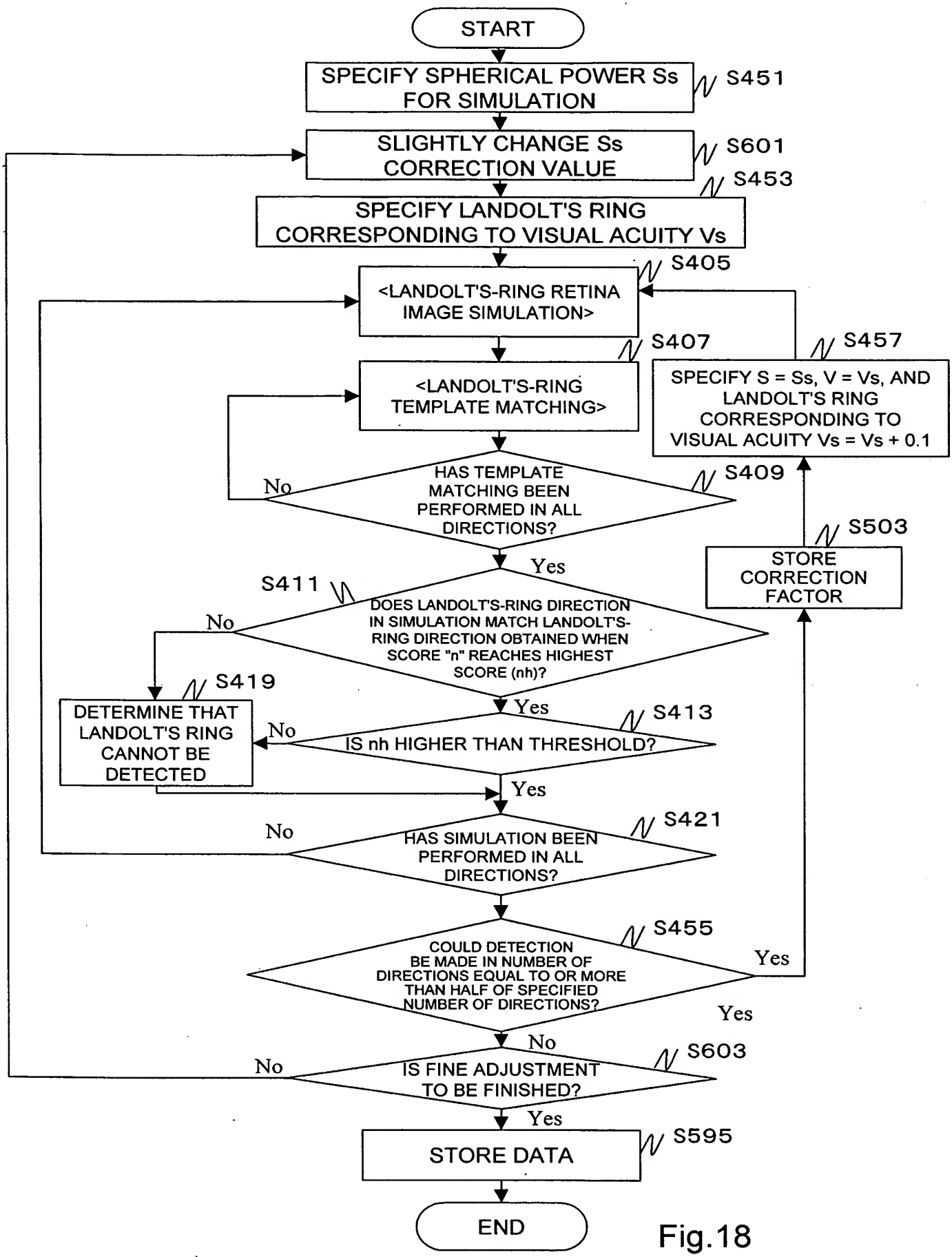
START
SPECIFY SPHERICAL POWER Ss FOR SIMULATION
S451
SLIGHTLY CHANGE Ss CORRECTION VALUE
S601
S453
SPECIFY LANDOLT'S RING CORRESPONDING TO VISUAL ACUITY Vs
S405
<LANDOLT'S-RING RETINA IMAGE SIMULATION>
S407
<LANDOLT'S-RING TEMPLATE MATCHING>
S457
SPECIFY S = Ss, V = Vs, AND LANDOLT'S RING CORRESPONDING TO VISUAL ACUITY Vs = Vs + 0.1
S409
HAS TEMPLATE MATCHING BEEN PERFORMED IN ALL DIRECTIONS?
No
Yes
S503
STORE CORRECTION FACTOR
S411
DOES LANDOLT'S-RING DIRECTION IN SIMULATION MATCH LANDOLT'S-RING DIRECTION OBTAINED WHEN SCORE "n" REACHES HIGHEST SCORE (nh)?
No
Yes
S419
DETERMINE THAT LANDOLT'S RING CANNOT BE DETECTED
S413
IS nh HIGHER THAN THRESHOLD?
No
Yes
S421
HAS SIMULATION BEEN PERFORMED IN ALL DIRECTIONS?
No
S455
COULD DETECTION BE MADE IN NUMBER OF DIRECTIONS EQUAL TO OR MORE THAN HALF OF SPECIFIED NUMBER OF DIRECTIONS?
Yes
Yes
No
S603
IS FINE ADJUSTMENT TO BE FINISHED?
No
Yes
S595
STORE DATA
END

Fig.18

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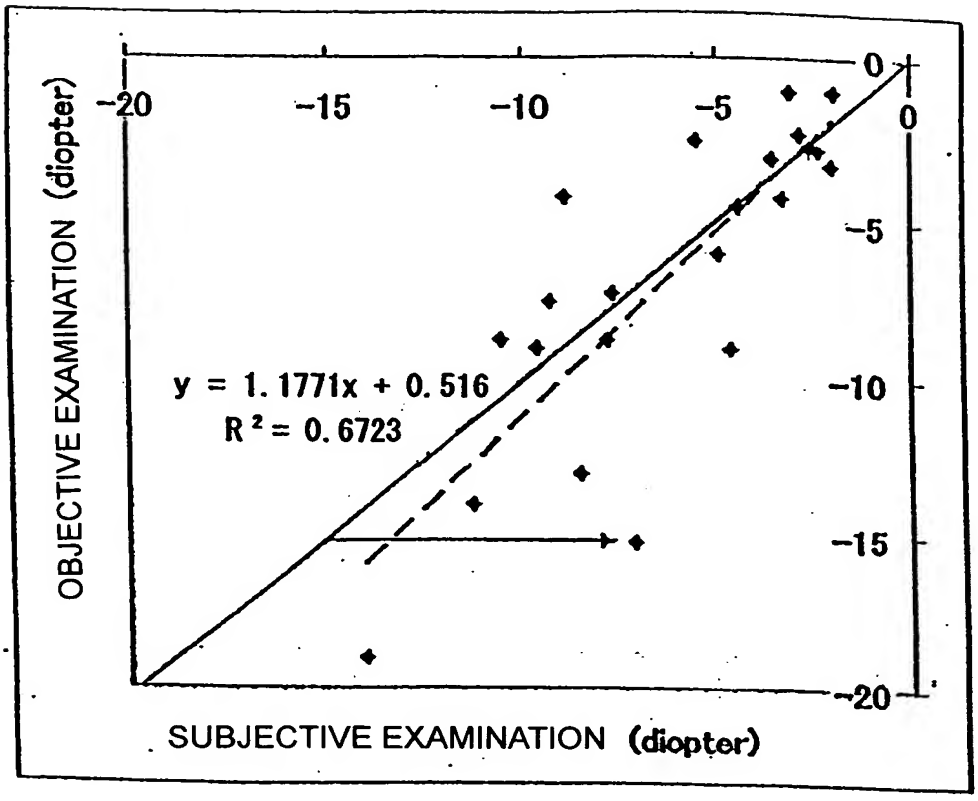

FIG. 19

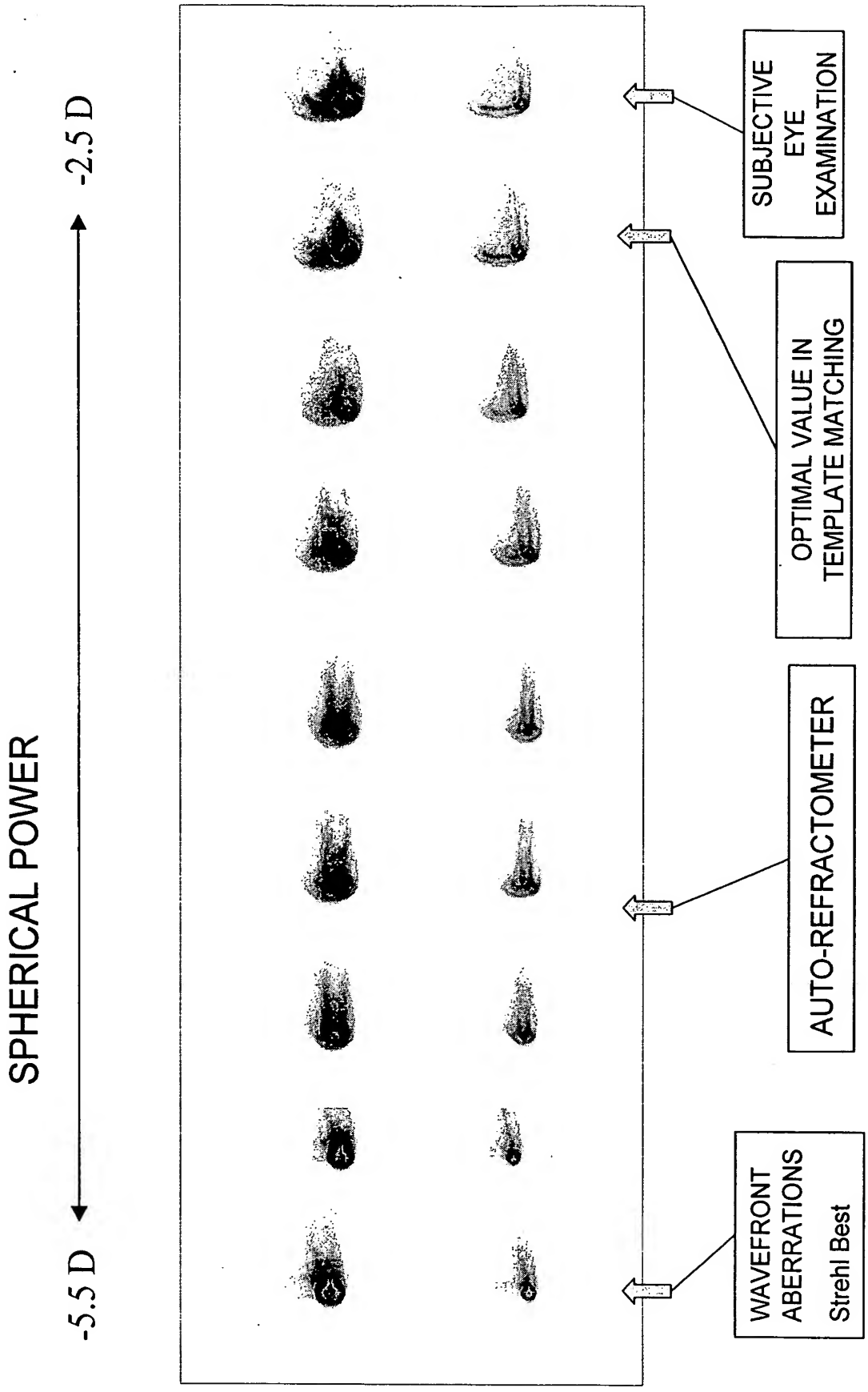

Fig.20

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FIG. 21

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